CALIFORNIA DEPARTMENT OF TRANSPORTATION
DIVISION OF TRAFFIC OPERATIONS

SPECIFICATIONS FOR ALUMINUM SIGNS LAMINATED AND FORMED ROADSIDE AND OVERHEAD APPLICATIONS

I. SCOPE

These specifications define the minimum requirements for laminated signs (overhead Type A and roadside Types B and H) and formed signs (both roadside and overhead). Signs are aluminum and faced with retroreflective sheeting.

II. DEFINITIONS

1. ASTM
   Specifications of the American Society for Testing and Materials.
   Web site: http://www.astm.org
2. CONTRACTOR
   The person or persons, firm, partnership, corporation, or combination thereof, who have entered into a contract with the State of California.
3. DOT
   The California Department of Transportation and/or its agents acting within the scope of the particular duties delegated to them.
4. PLANS
   Plans are sign/installation orders, fabrication details, sign specification sheets, drawings, sketches, or reproductions thereof approved by the California Department of Transportation which show the character, dimensions and details of the work to be performed.
5. SPECIFICATIONS
   Specifications of the California Department of Transportation for aluminum signs laminated and formed roadside and overhead applications.
6. STANDARD PLANS
   The 1999 Standard Plans of the California Department of Transportation.
   Web site: http://www.dot.ca.gov/hq/esc/oe/conststand.html
7. STANDARD SPECIFICATIONS
   The 1999 Standard Specifications of the California Department of Transportation. Web site: http://www.dot.ca.gov/hq/esc/oe/conststand.html
8. STATE
   The State of California and/or its agents acting within the scope of the particular duties delegated to them.

9. TRAFFIC MANUAL
   The 1996 Traffic Manual of the California Department of Transportation.
   Web site: http://www.dot.ca.gov/hq/traffops/signtech/signdel/trafficmanual.htm
10. TRANSPORTATION LABORATORY
    The Transportation Laboratory of the California Department of Transportation and/or its agents acting within the scope of the particular duties delegated to them.

The Contractor should have knowledge of Chapters 4 and 5 of the Traffic Manual, Section 56 "Signs" of the Standard Specifications, and Standard Plans for "Roadside" and "Overhead" signs.

Note: These specifications show both the International System of Units (Metric) and English Units of measurement. Corresponding English Units are show in parenthesis next to the Metric Units.

III. QUALITY CONTROL PROGRAM

No later than ten days prior to fabrication of signs the Contractor shall submit a copy of its "Quality Control Program" to the Transportation Laboratory at 5900 Folsom Blvd, Sacramento, CA 95819 (c/o Lisa Dobeck). Fabrication of signs may not commence until the Transportation Laboratory has received and approved the Contractor's "Quality Control Program" in writing. The "Quality Control Program" shall include, but is not necessarily limited to the following items:

1. Identification of the party responsible for quality control of signs,
2. Basis of acceptance of incoming raw materials at the fabrication facility,
3. Type, method and frequency of quality control testing at the fabrication facility,
4. Method for recording quality control data,
5. List (by manufacturer and brand name) of screening inks and process pastes, protective film, protective coating, retroreflective and non-reflective sheeting materials, and opaque surface coatings,
6. Recommended cleaning procedure for each product, and
7. Inspection procedures at the fabrication facility.

Test samples of signs and/or materials in various stages of production shall be furnished to the DOT upon request. Sample signs shall be 300 mm x 300 mm (12 inches x 12 inches) base panels with applied background, letter or numeral, and border strip as requested.

IV. SIGN IDENTIFICATION

The following notation shall be placed on the lower right side of the back of each sign where it will not be blocked by a sign post or frame:

1. PROPERTY STATE OF CALIFORNIA,
2. Name of the Contractor,
3. Month and year of sign fabrication,
4. State contract number of the contract,
5. Type of retroreflective sheeting or surface coating,
6. Manufacturer's identification and lot number of retroreflective sheeting, and
7. The type and trade name of protective film or coating.

The above notation shall be applied directly to aluminum sheet in 6 mm (¼ inch) upper case letters and numerals by die-stamp or by equivalent method for fiberglass reinforced plastic signs. Painting, inking, or engraving is not acceptable. The notation shall be applied in a manner that will not damage the finish of the sign.

The notation "PROPERTY STATE OF CALIFORNIA" shall be screened on the lower center of the face of each sign. The notation shall be in 6 mm (¼ inch) white upper case letters placed within a visible white border. It shall be applied prior to application of protective film or coating and shall not be placed over legend or bolt holes.

On signs with protective film or coating the notation "APPLIED GRAFFITI PROTECTION" shall be screened on the lower right of the face of each sign. The notation shall be in 10 mm (3/8 inch) black upper case letters placed within a visible black border. It shall be applied prior to application of protective film or coating and shall not be placed over legend or bolt holes.

V. TRANSPORT AND STORAGE

1. TRANSPORT

All signs regardless of kind, size, type or whether delivered by the Contractor or by common carrier shall be protected by thorough wrapping, tarping, or by other means to ensure that signs are not damaged during transit or by weather conditions. Signs shall be dry during transit and arrive on palettes, in crates, or in tier racks when shipped from the fabricator. Appropriate padding/protective materials shall be placed between signs to reduce the risk of abrasion/damage during shipment. Wet, damaged, or defective signs will be rejected.

2. STORAGE

Signs shall be stored on edge in dry environments and with padding/protective materials remaining between sign faces at all times. Signs shall not rest directly on the ground and become wet during storage. In areas of high heat and humidity signs shall not be stored in enclosed non-climate-controlled trailers or containers. For storage over 30 days signs shall be stored indoors. When stored outside there shall be a minimum spacing of 100 mm (4 inches) between signs.

When stored indoors or outside signs shall be free standing or leaning against each other in a manner that does not apply pressure to the face of signs.

VI. DESIGN AND APPEARANCE OF FINISHED SIGN

1. DESIGN

Roadside and overhead signs of the types specified herein shall be fabricated and furnished as shown on the plans and the DOT sign specification sheets, as provided in these specifications and in accordance with the details available from the DOT web site at
http://www.dot.ca.gov/hq/traffops/signtech/signdel/plates.htm and at
http://www.dot.ca.gov/hq/traffops/signtech/signdel/sheets.htm

The DOT sign specification sheets are available for purchase at

Department of Transportation
Publication Distribution Unit
1900 Royal Oaks Drive
Sacramento, California 95815-3800
(916) 445-3520

Prior to layout and design of signs the Contractor should check for the latest revisions of sign specification sheets which are available from the DOT web site at http://www.dot.ca.gov/hq/traffops/signtech/signdel/specs.htm

All other signs shall be made in accordance with drawings shown on the plans or as mutually designed and agreed to by the Contractor and the DOT. The layout of legend shall be the Contractor's responsibility subject to review and approval by the DOT.

Legend shall not be installed at the work site. Legend shall include all letters, numerals, arrows, route shields, symbols, and borders. The style, font, and size of legend shall conform to the requirements specified in the Federal Highway Administration (FHWA) publication "Standard Alphabets for Highway Signs and Pavement Markings" which is available for purchase from the FHWA web site at http://mutcd.fhwa.dot.gov/ser-pubs.htm

2. APPEARANCE

The face of each finished sign shall be uniform, flat, smooth, and free of defects, scratches, wrinkles, gel, hard spots, streaks, extrusion marks, air bubbles, or blemishes that may affect the serviceability and detract from the general appearance and color of the sign when viewed from a distance of 7.6 m (25 feet). The front, back, and edges of the sign shall be free of router chatter marks, burns, sharp edges, loose rivets, delaminated skins, excessive adhesive

over spray and aluminum marks. No repair to the sign will be allowed except when approved by the DOT.

Signs exhibiting a significant color difference between day and night shall be replaced at the Contractor's expense.

On multiple panel signs legend shall be placed across joints in a manner that does not affect the size, shape or appearance of the legend. Slight adjustments in legend may be made to avoid joints. Legend placed across joints of interior edges of formed panels will require special treatment as shown on the details (Plate 16) to prevent delamination of letters, numerals, arrows, route shields, and symbols.

No sign panel shall have more than one splice in the retroreflective sheeting. When retroreflective sheeting is placed by squeeze roller application no splice will be allowed except splices produced during manufacture of the sheeting. When retroreflective sheeting is placed by vacuum application no splice will be allowed on panels with a minor dimension of 1220 mm (48 inches) or less except splices produced during manufacture of the sheeting. Only one horizontal splice will be allowed for rectangular signs with a minor dimension greater than 1220 mm (48 inches).

Splices in retroreflective sheeting shall overlap adjoining material. The overlap shall be a minimum of 25 mm (1 inch). Except for horizontal border strips the overlap shall be in the direction of top to bottom of the sign to prevent moisture penetration from above. Splices shall not be placed within 50 mm (2 inches) from the edge of panels. Adjoining retroreflective sheeting at splices shall not exhibit a color difference under incident and reflected light.

Fastening rivets shall be aluminum of the type and color shown on the plans and approved by the DOT.

VII. RETROREFLECTIVE SHEETING

The retroreflective sheeting shall be the color and type of material shown on the plans for background and legend. The products presently being manufactured or marketed by the following firms have been evaluated and found to comply with DOT requirements for retroreflective sheeting:

1. ASTM Type II
   a) Avery Dennison T-2500 Series
   b) Kiwalite Type II
   c) Nikkalite 1800 Series
2. ASTM Type III
   a) Avery Dennison T-5500A Series
   b) Nikkalite Ultralite Grade II

c) 3M 3800 Series

3. ASTM Type IV
   a) Avery Dennison T-6500 Series
   b) Nikkalite 94000 Series
4. ASTM Type VIII
   a) Avery Dennison T-7500 Series
5. ASTM Type IX
   a) 3M VIP 3990 Series

Only the retroreflective sheeting colors and types approved by the DOT listed above shall be used unless otherwise approved by the Transportation Laboratory.

Adhesive backing for retroreflective sheeting shall be pressure sensitive and fungus resistant in accordance with the requirements of the latest ASTM Designation D4956. Backing shall be Class 1, Class 3, or Class 4 for Types II, III, IV, VIII, and IX. In addition backing may be Class 2 for Type II.

Retroreflective sheeting shall be applied to the base sheet in accordance with the recommendations of the retroreflective sheeting manufacturer using either (a) an approved vacuum applicator using a combination of vacuum and heat, or (b) a squeeze roller applicator. The retroreflective sheeting shall be handled, processed, and applied without appreciable stretching, tearing or other damage.

After fabrication the retroreflectivity of finished signs shall meet the "Minimum Coefficient of Retroreflection" values of the latest ASTM Designation D4956.

After fabrication the colors and luminance factors of finished signs shall conform to the "Color Specification Limits" and respective "Luminance Factor" requirements of the latest ASTM Designation D4956 for the type and color of retroreflective sheeting or the Federal Highway Administration’s "Color Tolerance Chart" which is available from the FHWA web site at
http://mutcd.fhwa.dot.gov/texts/t23pt655subpartF_app.htm

The instrumental method of determining color shall conform to the requirements of the latest ASTM Designation D4956. In the event of any dispute concerning the results of instrumental testing a visual test by the Transportation Laboratory shall prevail.

VIII. SCREENING INKS, PROCESS PASTES, BLACK NON-REFLECTIVE SHEETING, AND PROTECTIVE FILMS

All screening inks, process pastes, black non-reflective sheeting, and protective films are subject to approval by the Transportation Laboratory. Only those screening inks, process pastes, black non-reflective sheeting, and protective films that are recommended by the manufacturer of the retroreflective sheeting and shown in the Contractor's "Quality Control Program"shall be used.

The Contractor shall be responsible for having all colors required to produce signs in accordance with these specifications.

The Contractor is responsible for legend pattern, silk screen layouts, set-ups, all components, fabrication, and labor necessary to furnish a finished sign.

Unless otherwise prohibited screening inks or process pastes may be substituted for manufactured colors at the option of the Contractor to produce both legend and background. Only the screened colors of green, blue, red, brown and black may be substituted. Substitutions are subject to approval by the Transportation Laboratory.

Black non-reflective sheeting for legends may be used in lieu of black process paste. The adhesive backing of the sheeting shall be pressure sensitive and fungus-resistant.

The outdoor weatherability of applied inks, pastes, and black non-reflective sheeting shall be comparable to the outdoor weatherability of the retroreflective sheeting it is applied to.

It is the responsibility of the Contractor to ensure that all proposed retroreflective sheeting, screening inks, process pastes, black non-reflective sheeting, and protective films are fully compatible with each other.

Adherence of process inks shall withstand removal when tested by applying standard cellophane tape over a properly cured; color processed area and removing the tape with one quick motion at an angle of 90^{o}.

Transparent inks shall be processed and applied in accordance with the recommendations of the manufacturer of the retroreflective sheeting. After fabrication the minimum transparent retroreflectivity of colors processed on white retroreflective sheeting shall not be less than 70% of the "Minimum Coefficient of Retroreflection" values of the latest ASTM Designation D4956 as measured at 0.2° observation angle and -4° entrance angle expressed in candelas per lux per square meter (candelas per foot-candle per square foot). Except after fabrication the minimum transparent retroreflectivity of red, blue and green processed on white retroreflective sheeting shall not be less than the values shown below as measured at 0.2° observation angle and -4° entrance angle expressed in candelas per lux per square meter (candelas per foot-candle per square foot).

Red	22.5
Blue	10.0
Green	22.5

After sign fabrication the colors and luminance factors of finished signs shall conform to the "Color Specification Limits" and respective "Luminance Factor"

requirements of the latest ASTM Designation D4956 for the type and color of retroreflective sheeting.

The instrumental method of determining color shall conform to the requirements of the latest ASTM Designation D4956. In the event of any dispute concerning the results of instrumental testing a visual test by the Transportation Laboratory shall prevail.

The screened surface of signs shall be smooth and flat to facilitate cleaning and maintain wet performance. The surface shall exhibit an 85^{o} gloss rating of not less than 40 according to the latest ASTM D523.

When shown on the plans signs shall be covered with protective film. The products marketed or manufactured by the following firms have been evaluated and found to comply with the DOT requirements for anti-graffiti protection:

1. STANDARD FILM
   a) Safe-Face V15B-SAF
   b) 3M Scotchlite 1150A
   c) Nikkalite #142
2. PREMIUM FILM
   a) Nikkalite EF-40801
   b) Avery Dennison OL-1000
   c) 3M Scotchlite 1160A

Protective films or spray-on coatings considered equivalent to those listed above may be substituted when matched components are requested by the Contractor. Substitutions are subject to DOT approval.

Matched components are protective films or spray-on coatings specifically recommended by the manufacturer for use on its retroreflective sheeting. The recommendation shall be in writing from the manufacturer of the retroreflective sheeting.

IX. MAINTAINED PERFORMANCE OF SIGNS AFTER INSTALLATION

After installation sign retroreflectivity shall not degrade below 80% of the "Minimum Coefficient of Retroreflection" values of the latest ASTM Designation D4956 for a period of seven (7) years from the date of fabrication as measured at 0.2° observation angle and -4° entrance angle expressed in candelas per lux per square meter (candelas per foot-candle per square foot).

X. ALUMINUM SHEETING

Aluminum sheeting shall be 6061-T6 or 5052-H38 alloys conforming to the requirements of the latest ASTM Designation B209 unless shown otherwise on the plans or in these specifications.

The thickness of the aluminum sheeting shall be as shown on the plans or in these specifications. The sheeting is subject to inspection by the Transportation Laboratory prior to degreasing operations. Alloy and temper designations shall be verified by mill certification.

Aluminum sheeting shall be free of buckles, warps, dents, cockles, burrs, and any other defects resulting from fabrication processes. Base plates for standard route shields shall be die-cut. All possible fabrication including shearing, cutting and punching of holes shall be completed prior to pretreatment of the sheeting.

The front and back surfaces of all aluminum sheeting shall be cleaned, deoxidized, and coated with a light, tightly adherent chromate conversion coating free of any powdery residue. The pretreatment process shall be in conformance with the provisions in Section 5 "Recommended Processing Methods" of the latest ASTM Designation B449. The coating weight shall be Class 2, 108 mg/m^2 to 377 mg/m^2 (10 mg/ft^2 to 35 mg/ft^2), with a median of 269 mg/m^2 (25 mg/ft^2) as the optimum coating weight.

All treatment tanks or spray applied pretreatment systems shall be charged with fresh chemicals at least once a year. If pretreatment is performed by immersion methods the tanks shall be of sufficient size to accommodate the entire sheet. Titration equipment shall be available for use by the Transportation Laboratory to check the solution strengths. The cleaned and coated sheeting shall be handled only by a mechanical device or by operators wearing clean cotton or rubber gloves. After cleaning and coating operations the sheeting shall be protected at all times from contact or exposure to grease, oils, dust or other contaminants.

Other pretreatment methods similar to those specified above may be used provided prior approval is obtained from the Transportation Laboratory.

XI. LAMINATED PANEL

1. GENERAL

Laminated panels shall be fabricated and furnished as shown on the plans, as provided in these specifications and in accordance with details (Plates 1 through 10) available from the DOT web site at http://www.dot.ca.gov/hq/traffops/signtech/signdel/plates.htm
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For signs 1.52 meters (5 feet) or less in height the panel shall be fabricated as a contiguous unit with no horizontal joints, splices or seams. For signs greater than 1.52 meters (5 feet) in height the Contractor may determine the height of each panel.

Overall dimensional tolerances of laminated panels shall be within +3 mm (+1/8 inch) or -13 mm (-1/2 inch) of the detailed or specified dimensions. The difference in length between adjoining panels of multiple panel signs shall not be greater than 13 mm (1/2 inch).

Laminated panels shall consist of two aluminum sheets laminated to a honeycomb core and extruded aluminum frame to produce flat and rigid panels of 25 mm (1 inch) or 64 mm (2 ½ inches) nominal thickness. Extrusions for aluminum frame of laminated panels shall be aluminum alloy 6063-T6.

The face of laminated panels shall be fabricated in one piece from 1.6 mm (0.063 inch) sheet aluminum alloys 6061-T6 or 5052-H38. The back of laminated panels shall be fabricated in one piece from 1.0 mm (0.040 inch) sheet aluminum alloy 3003-H14. Both face and back sheets shall be pretreated in accordance with the requirements for Aluminum Sheeting of these specifications.

Weepholes of minimum 3 mm (1/8 inch) diameter shall be drilled in the perimeter frame at the bottom of each panel. Weepholes shall be drilled at the center and at approximately 80 mm (3 inches) from each end of the perimeter frame. Other holes drilled in the frame for fabricating purposes shall be filled with a stainless steel screw with neoprene washer or with an aluminum rivet.

The core material shall be phenolic impregnated kraft paper honeycomb. The honeycomb cell size shall be 13 mm (½ inch). Core material shall conform to specification MIL-D-5272 for fungus resistance. The weight of kraft paper shall be 300 g/m^2 (80-pound) and impregnated minimum 18% by weight.

The laminating adhesive shall produce a resilient oil and water-resistant bond. The weight of adhesive and method of application shall be sufficient to ensure contact of surfaces with no evidence of interior or edge delamination. Delamination has occurred if a feeler gauge 0.25 mm (0.010 inch) in thickess by 13 mm (½ inch) in width can be inserted to a depth of more than 13 mm (½ inch) between the frame and the sheeting.

An aluminum rivet shall be placed at each corner of the panel to further secure the face and back sheets to the perimeter frame. The face rivets shall be anodized to the same color as the sign face. Diameter of the rivets shall not exceed 5 mm (3/16 inch).

Finished laminated panels shall be flat. Wrinkles, ripples, dents or waves in the face sheet will not be acceptable unless they fall within a flatness tolerance of +/-8 mm per meter (+/-3/32 inch per linear foot). This will be determined by locating the high spots of adjacent wrinkles, ripples, dents or waves and determining the depth of the trough with respect to the distance between crests. Where multiple panel signs adjoin the face and back sheets shall be flush with the channel edge and the edge shall be straight within +/-1 mm (+/-1/32 inch) from a straight plane. Otherwise face and back sheets shall be flush with channel edges within +/-3 mm (+/-1/8 inch) and channel edges shall be straight within +/-3 mm (+/-1/8 inch) from a straight plane. All edges shall be smooth.

On laminated multiple panel signs the fabricator shall place closure extrusions in the top channel of bottom panels shown on Plate 3. The closure extrusion shall be aluminum alloy 6063-T6. In the closed position perimeter frames of adjoining multiple panel signs shall accommodate the closure extrusion.

2. OVERHEAD TYPE A PANEL

Overhead laminated panels shall be Type A panel 25 mm (1 inch) nominal thickness.

Maximum size of Type A overhead laminated panels shall be 7.32 meters (24 feet) in length and 1.52 meters (5 feet) in height. For signs 7.32 (24 feet) meters or less in length the panel shall be fabricated as a contiguous unit with no vertical joints, splices or seams. For signs greater than 7.32 meters (24 feet) in length the DOT will provide the length of each adjoining panel. Minimum panel height shall be 508 mm (20 inches). The panel length and height shall be graduated in increments of 305 mm (1 foot) and 254 mm (10 inch) respectively.

The perimeter frame for Type A panels shall be assembled by means of self-tapping hex head stainless steel screws as shown on Plate 10. A sealant shall be used at corners to prevent moisture penetration. The horizontal top and bottom perimeter frame shall have an integral retainer track (modified "H" extrusion) for affixing mounting bolts to provide blind fastening of sign panel to support (Plates 5, 6, and 10). The vertical sides of the perimeter frame shall be extruded channel (Plates 5, 6, and 10).

The Contractor shall furnish fastening hardware including closure inserts, clamps, bolts, nuts, and washers for Type A overhead laminated panels (Plates 7, 8, and 9).

3. ROADSIDE TYPE B AND H PANEL

Roadside laminated panels shall be Type B or Type H . Type B panels shall be 25 mm (1 inch) or 64 mm (2 ½ inch) nominal thickness. Type H panels shall be 64 mm (2 ½ inch) nominal thickness.

Maximum size of Type B panel (25 mm [1 inch] nominal thickness) shall be 4.57 m (15 feet) in length and 1.52 m (5 feet) in height. Maximum size of Type B and Type H panels (64 mm [2 ½ inch] nominal thickness) shall be 7.32 m (24 feet) in length and 1.52 m (5 feet) in height. Minimum height of Type B and Type H panels shall be 457 mm (18 inches). Length and height of Type B and Type H panels shall be graduated in increments of 152 mm (6 inches).

Perimeter frame for Type B panels shall be extruded channel. For Type B panels (25 mm [1 inch] nominal thickness) extruded channel shall be 25.4 mm (1 inch) x 25.4 mm (1 inch) x 1.6 mm (0.063 inch) in size, and for Type B panels (64 mm [2 ½ inch] nominal thickness) extruded channel shall be 25.4 mm (1 inch) x 63.5 mm (2 ½ inch) x 2 mm (0.080 inch) in size. The perimeter frame shall be heliarc welded at the corners. Corners of panels shall be sealed against moisture penetration. Vertical extruded tube (tube spacer) shall be heliarc welded to the perimeter frame where panels are attached to posts. Extruded tube shall be 25.4 mm (1 inch) x 25.4 mm (1 inch) x 1.6 mm (0.063 inch) in size for Type B panels (25 mm [1 inch] nominal thickness) and 25.4 mm (1 inch) x 63.5 mm (2 ½ inches) x 2.0 mm (0.080 inch) (Plates 2, 2A and 4) in size for Type B panels (64 mm [2 ½ inch] nominal thickness).

Perimeter frame for Type H panels shall be assembled by means of self-tapping hex head stainless steel screws. A sealant shall be used at the corners to prevent moisture penetration. The horizontal top and bottom perimeter frame shall be extruded tube-channel (Plates 1, 5 and 6A). The vertical sides of the perimeter frame shall be extruded channel (Plates 1, 5, and 6A). Type H panels with asymmetrical post spacing or Type H panels of 5182 mm (17 feet) or more in length require an additional extruded tube (centerline panel tube) along the horizontal axis of the panel frame (see Plate 1 for table defining large panels). The additional horizontal tube shall be firmly affixed at each end. The vertical extruded tube (tube spacer) shall be heliarc welded to both the horizontal tube and the perimeter frame.

The Contractor shall furnish closure inserts for Type B and Type H roadside laminated panels.

XII. FORMED PANEL

1. GENERAL

Formed panels shall be fabricated in accordance with details on Plates 11, 16 and 17.

Formed panels shall be fabricated in one piece from 1.6 mm (0.063 inch) sheet aluminum alloy 5052-H32. The sheeting shall be pretreated in accordance with the requirements for Aluminum Sheeting of these specifications.

Extrusions for aluminum frame of formed panels shall be aluminum alloy 6063-T6. The aluminum frame shall be affixed to the panel by means of aluminum rivets placed through the sign face. The rivets shall be anodized to the same color as the sign.

Finished formed sign panels shall be flat within 10 mm/m (0.125 inch per linear foot).

2. OVERHEAD FORMED PANEL

Overhead formed sign panels shall be formed and framed as shown on Plate 16. The framing members shall be 25.4 mm (1 inch) x 25.4 mm (1 inch) x 1.6 mm (0.063 inch) extruded channels. The rivet spacing shall be as shown on Plate 16. The channel web on the interior horizontal struts shall be placed 90^{o} to the back of the sign and against the back of sign as show on Plate 16.

Overhead formed panels shall be 1214 mm (47-13/16 inches) in length (horizontal dimension) as shown on Plate 16. The right end panel may be 605 mm (23-13/16 inches) in length (horizontal dimension) when required as shown on Standard Plan S8B. Dimensional tolerance for panels shall be +/-2 mm (+/-1/16 inch) in length (horizontal dimension).

Maximum height (vertical dimension) of overhead formed panels shall be 3048 mm (120 inches). Minimum height (vertical dimension) shall be 1270 mm (50 inches). Height (vertical dimension) of panels shall be graduated in increments of 254 mm (10 inches). Dimensional tolerance for panels shall be +/-2 mm (+/-1/16 inch) in height (vertical dimension).

The holes for fastening overhead formed panel to steel frame of sign structure shall be drilled and of the size, spacing and location as shown on Plates 16 and 17. Holes shall be normal (90^{o}) to the front and back surfaces of the formed edge. Holes that are improperly drilled, located and/or spaced shall be sufficient cause for rejecting the entire panel.

The Contractor shall furnish fastening hardware including bolts, nuts, and washers for overhead formed panels as shown on Plates 16, 18, and 19.

3. ROADSIDE FORMED PANEL

Roadside formed signs shall be formed and framed by the Contractor as shown on Plate 11. The framing members shall be 25.4 mm (1 inch) x 25.4 mm (1 inch) x 1.6 mm (0.063 inch) extruded channels. The channel web on the interior vertical struts shall be placed against the back of the sign face as shown on Plate 11.

The Contractor is not required to furnish fastening hardware for formed roadside signs.

END OF DOT SPECIFICATIONS